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Usage of UPS in ATLAS

This note tries to collect the information needed in order to determine the usage of Uninteruptable Power Supplies (UPS) in the ATLAS experiment (excluding Level 3 safety systems) and to help users to define their needs.

1. Introduction

There are various reasons to use a UPS ranging from avoiding inconveniences of power cuts up to assuring the safety of the experiment. In order to ensure the correct operation of the UPS system in the (hopefully rare) cases when it will be needed, the system has to be carefully planned and implemented and maintenance is of prime importance. Therefore a homogeneous ATLAS-wide system managed by the CERN electrical service is strongly recommended. As UPS are quite costly and can create operational risks, their usage has to be restricted to necessary cases. It should be born in mind, that after even a very short general power cut most of ATLAS (and the LHC accelerator) will be off and it makes no sense to keep some equipment running just for convenience. The experience from LEP is that data taking usually restarts only after several hours after a general power cut.

2. Characteristics and purpose of UPS

A UPS consists essentially of a rectifier, which charges a battery, which in turn feeds a DC/AC converter to supply, in our case, 230V (or 400V) with 50 Hz to the equipment. These are so-called “on-line” UPS, which provide also (some) filtering. The category of “offline” UPS, which only toggles to the battery in case of a power outage is not considered, because this results in a short interruption of up to 100ms. The two main parameters of a UPS system are the *maximum power* it can deliver and for how much *time*. A UPS can either be fed by ‘secure’ power (eventually backed up by a Diesel generator), which is never interrupted by more than say two minutes or by the normal mains. As a general rule each equipment which is fed by a UPS must have a local emergency stop button.

Reasons to use a UPS include:

- Run the equipment during a power cut
- Get status information and enable basic control during a power cut
- Provide the possibility to shut down equipment in an orderly fashion in case power is cut and is not re-established within a certain time.
- Protect equipment against ‘power glitches’, i.e. micro-cuts of some (ten) millisecond duration.

The last case should however normally be handled internally in the low voltage power supply of the device (e.g. by capacitors) and not by an UPS. Equipment, which needs to run continuously but tolerates a short interruption of power of the order of a minute, can be directly connected to ‘secure’ power and does not need an UPS.

Different classes of UPS installations can be identified:

- UPS fed by 'secure' power and **not** interrupted by a *general* emergency stop. Typical consumers include equipment, which is vital for security and safety systems. Examples are interlock systems, very basic parts of DCS and maybe small cooling systems (e.g. Si).
- UPS fed by 'secure' power, but cut by a *general* emergency stop. Examples may be gas systems.
- UPS fed by normal power and cut by *general* emergency

The 48 V DC distribution grid could be considered as another possible source of uninterrupted electricity supply

3. Practical considerations

A few points have to be considered before deciding on using a UPS:

- During a general power cut the primary cooling is likely to be off, hence the equipment must be able to run without cooling.
- Equipment with belongs logically together should be fed by the same UPS.
- Equipment running from an UPS should be monitored and controlled by DCS.
- The power consumption should not have a big inductive or capacitive component.
- A UPS can present a safety risk, as it may supply tension, when somebody does not expect it and it may not have a differential security.

DCS will monitor the status of the UPS and information about mode of operation, battery status, error conditions, etc. will be available. With this input, the users can control their equipment, e.g. shut it down before the batteries get empty.

The ATLAS UPS system should be defined within the frame of the ATLAS Technical Co-ordination and be implemented by the CERN Electrical Services. This will probably be done by a dedicated network, which has to be subdivided into segments such that faulty equipment or overload conditions do not stop the whole network.

In order to design the overall ATLAS UPS system the users (subdetectors etc.) have to define their requirements. Typical parameters are:

- Maximum power load (in VA)
- Maximum autonomy
- Logical and hierarchical organisation of the equipment
- Location of equipment
- Location of local emergency stops
- Reaction to global emergency stops
- Interlocks (e.g. to cooling)
- Reaction of system when mains power comes back
- Controls requirements of the equipment
- Possible location of the UPS
- Financial aspects

Apart from the investment cost for the UPS itself, substantial additional costs arise like installation of the unit and the network, yearly maintenance, regular replacement of batteries and last but not least space is needed!